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WEED-EATING SNAILS
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Weed Control

No single production problem facing American farmers is as expensive and difficult as weed control. In this fight against weeds, U.S. farmers annually spend an estimated $2½ billion. This compares with only $430 million in controlling crop insects and $230 million in keeping down plant disease damage.

By developing low-cost ways of controlling weeds, ARS scientists are helping farmers, whether they farm large acreages or small, to be more efficient. Looking ahead, farmers in the developing nations will be able to take advantage of this technology.

Scientists are approaching this problem on a broad front and have already helped provide farmers with a wide range of sophisticated mechanical and chemical weed control methods. The future holds much more, as attested by several articles in this issue.

ARS plant physiologists at Beltsville, Md., for example, are investigating the effect that a light-filtering pigment found in plant leaves, phytochrome, has no weed seed germination (p. 7). This approach may enable scientists to learn how to trigger germination of seeds lying dormant in fields because of the absence of light.

Another approach is to develop crops that beat out weeds in the battle for survival. At Stoneville, Miss., scientists found that two varieties of soybeans have just such a built-in resistance to weeds (p. 16).

Biological control methods may help farmers and others who must control aquatic weeds in irrigation canals, ditches and waterways. Besides clogging many waterways to the detriment of boaters and water sports enthusiasts, aquatic weeds cause great water loss through evapotranspiration (AGR. RES., October 1967, p. 8).

ARS scientists at Fort Lauderdale, Fla., are studying two weed-eating snails imported from South America and seeking ways to mass-product them for evaluation and ultimate use in the biological control of elodea, southern naiad, coontail and other aquatic weeds (p. 8).

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Toxic Species of Lupine Cause

CROOKED CALF DISEASE

Calf exhibiting crooked calf syndrome. Signs are twisted and malaligned leg bones, twisted backs or necks or cleft palates (PN–1595).

TOXIC SPECIES of lupine weed eaten by cows during early pregnancy cause crooked calf disease, a crippling cattle disorder present at birth.

In a survey of the disease among beef herds totaling 6,000 cattle near Arco, Idaho, an average of 2½ percent of the calves were affected. On one ranch, every calf was deformed.

Stricken calves have twisted and malaligned leg bones, twisted backs or necks, or cleft palates. One or more of these defects can cause disability ranging from inability to move or eat to harmless bone alterations that are noticeable only on X-ray films.

Research veterinarian Wayne Binns and his staff at the ARS Poisonous Plant Research Laboratory, Logan, Utah, have followed field outbreaks of crooked calf disease for more than 10 years. Although crooked calf deformities are similar to some hereditary defects, changing breeding stock has proved ineffective.

Binns noticed that only cows grazing on the range seemed to produce deformed calves, so he came to the conclusion that a dietary poison—rather than poor heredity—was bedeviling affected herds.

To clarify this suspicion, Binns mated a test herd of cows with typical leg and neck deformities to a bull almost immobilized with multiple deformities of crooked calf disease. If the disease was caused by a simple recessive hereditary condition—such as dwarfism in cattle—one calf in four would have crooked calf deformities. In fact, all the calves born during the trial were normal. Apparently heredity did not have a direct effect on crooked calf disease, proving that ranchers trying to control the disease shouldn't cull cows just because they have minor crooked calf deformities.

Assuming that heredity was not at fault, Binns studied the possibility that the cause might be found in the feed or water of afflicted herds. With the help of the ARS Plant, Soil and Nutrition Laboratory, Ithaca, N.Y., hundreds of chemical analyses were made of soil, plants, and water from ranches troubled by the disease.

The cooperators found two possible problems: potentially poisonous lead in the drinking water or the possibly poisonous plant, lupine, in the feed. The first experimental case of crooked calf disease Binns was able to study was produced by feeding both lupine and lead to a cow during pregnancy.

To determine the extent to which either or both of these suspects were involved in causing crooked calf disease, Binns fed a test herd in three groups. One was given lupine; a second, lupine and lead; and a third, lead alone. The basic ration of all cows consisted of good quality hay, supplemented with ample minerals for proper nutrition of calf fetuses.

Results showed that 50 percent of the cows given lupine alone aborted or gave birth to calves with slight to severe malformations; cows given

lupine and lead had 53 percent abortions or malformations; but none of the cows fed lead alone had abortions or deformed calves.

Binns compared the malformations found in calves from the experiment with typical crooked calf deformities in commercial herds. Direct examination and X-ray studies showed that malformations were identical.

Lupine, or beanweed, is a plant of the pea family with multiple leaflets radiating fingerlike from a common point. A spike of white, pink, yellow, or bluish florets projects from the top. Only a few of the more than 100 known species have so far been found toxic.

When cows graze toxic lupines, they themselves may show moderate reactions. They exhibit a reluctance to move and walk stiff-legged; their coat is rough, their nose is dry, and their feces are hard. But although, in many cases, these cows later produce deformed calves, there is no direct relation between severity of symptoms in the mother and likelihood or severity of deformity in the offspring.

Comparison of cows fed lupine during various stages of early pregnancy showed that the worst time for grazing them on contaminated ranges was between the 40th to 70th day of pregnancy. Slight to moderate bone malformations, however, did result during the trials, even when cows ate lupine after that time span.

Unfortunately, cows are very likely to eat lupine just at the critical time. In August, when most of the herd is 1 or 2 months pregnant, range pastures tend to dry up and good feed gets scarce. Cattle normally don't like lupine, but they eat it when there is no choice. The best way for ranchers to avoid crooked calf disease is to provide an alternative to lupine ranges, at least during the first 120 days of pregnancy.■

Use Herbicides To Kill Weeds, Let Them Remain on Fallow Soil

WHAT IS THE BEST WAY to kill weeds on fallow soil—with herbicides or conventional tillage methods?

"With herbicides," say D. E. Smika and G. A. Wicks. Smika, of ARS, is a research soil scientist and Wicks is an assistant professor specializing in weed control at the Nebraska Agricultural Experiment Station, North Platte.

Not only does this method allow better water storage, the scientists add, it also reduces erosion because of the mulching effect the dead weeds have on the soil.

Soil is fallowed to store water for the next crop in arid and semiarid States. Such soils have no opportunity to replenish moisture if crops are planted continuously.

Fallowing is criticized, however, because of the low percentage of precipitation moisture it actually saves. Weeds are one of the main reasons for the inefficiency.

Weeds cannot be allowed to grow unchecked. Left alone, they use up moisture needed by crops and the purpose of fallowing is defeated. When herbicides are used to control weeds, the soil's surface is left undisturbed and residues that help retain moisture are allowed to remain.

Usually, subsurface tillage or one-way disking is used to get rid of weeds. This reduces the percentage of moisture stored because tillage implements churn up the soil's surface and expose more of it to the sun's drying rays. Some tillage implements also pulverize the soil and make it more subject to erosion.

Smika and Wicks recorded a superior performance for herbicide-treated plots above tilled plots in 3-year tests at the North Platte Station.

Tests involved two kinds of crop rotation. One was a 3-year alternation of winter wheat, sorghum, and a fallow period. The other was a 2-year alternation of winter wheat and a fallow period.

Average percentage of moisture stored in the fallow soil in the 3-year rotation was 35.3 percent when tillage was used to control weeds and 42.5 percent when herbicides were used. In the 2-year rotation, moisture storage was 25 percent with tillage and no mulch and 43.7 percent with herbicides and a stubble mulch. To make the comparisons, data were recorded in three fallow periods.

The researchers made no systematic recording of erosion control data in their tests, but they are convinced the herbicide method has potential for slowing erosion on a wide scale. Smika and Wicks say that herbicides could be used over much of the Great Plains to increase moisture in fallow soil. They add that the cost of using available herbicides on a large scale would be prohibitive. One of the tasks of continuing research will be to develop a program economically feasible for the average farmer.■

WATER SHEEP ADEQUATELY . . .

To Reduce Chances of Oxalate Poisoning

RECENT RESEARCH revealing a tie between availability of water and oxalate poisoning of sheep suggests further reasons for providing adequate drinking water.

Because sheep—like humans—eat less than normal when they are without water for extremely long periods, they compensate by eating voraciously and nonselectively after finally satisfying their thirst. If that thirst is satisfied in an area heavily infested with plants producing toxic oxalic acid or salt, such as halogeton—a noxious Goosefoot herb found in western rangelands—they are likely to satisfy their hunger by grazing lethal amounts of these plants.

L. F. James, research animal husbandman, and other ARS scientists at the Utah Agricultural Experiment Station at Logan found that 18 ounces of halogeton containing 8.7 percent soluable oxalate can kill a fully fed sheep, and 12 ounces can kill a fasted sheep, although such factors as the animal's nutritional status and access to water affect the sheep's tolerance.

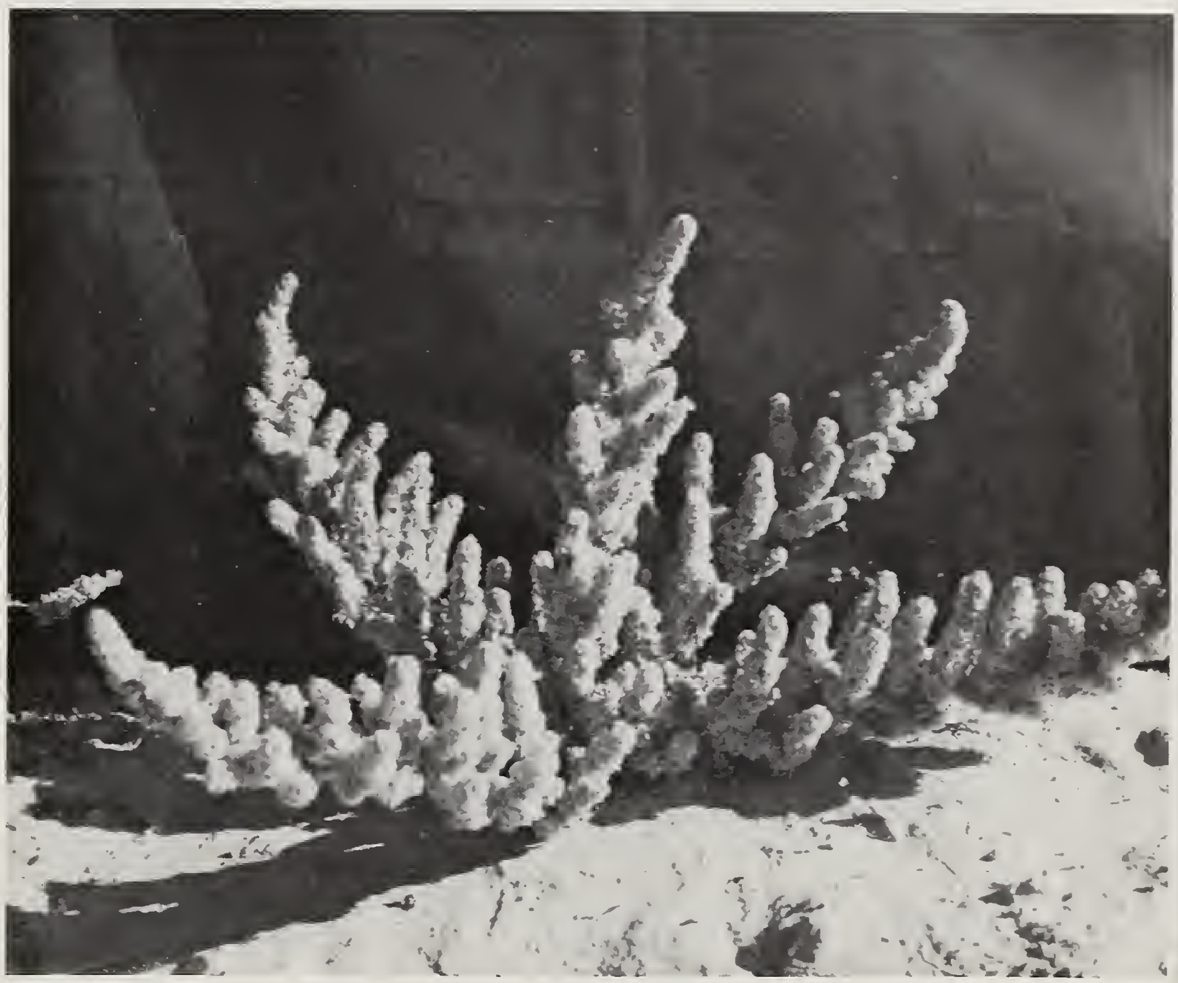
Sheep graze halogeton, which contains as much as 10 to 30 percent oxalates on a dry weight basis, in sublethal amounts under normal conditions. Spinach, rhubarb, and sugar beets also contain oxalates, but in much lower proportions.

Halogeton thrives around watered areas in the arid and semiarid western United States and has caused dramatic losses of sheep from late fall to early spring. Sheep encounter the plant as they seasonally move from waterhole to waterhole.

Besides pointing out that sheep should be adequately watered, scientists advise ranchers to introduce their flocks gradually—over 3 or 4 days—into areas where halogeton must be grazed. This precaution will allow the bacteria in the sheeps' stomachs to slowly become conditioned to destroying the oxalate.

Feeding supplemental calcium to sheep on halogeton infested ranges may prove beneficial because oxalate will combine with calcium in the stomach to form a nonabsorbable, harmless compound. Programs aimed at eradicating halogeton have proved disappointing.

Dullness, loss of appetite, nasal discharge, reluctance to follow the band, and increased water intake due to the salty taste of halogeton, signal the onset of halogeton poisoning. ■



Halogeton, showing Goosefoot configuration. Plant was originally introduced into North America from Siberia (PN–1596).

(*PN–1597*)

MANAGEMENT OF LIGHT

. . . Could Increase Corn Yields

A PHENOMENAL YIELD of 377 bushels of corn per acre on an experimental plot supports a theory that light, or the lack of it, is the chief limiting factor in present-day corn production.

University of Illinois agronomy professor J. W. Pendleton and ARS soil scientist D. B. Peters achieved this yield by installing aluminum reflectors to throw sunlight on the lower parts of corn plants.

During the past 10 years, farmers in the Corn Belt have increased corn yields from 65 bushels per acre to more than 100 bushels per acre through use of hybrids, fertilizers, irrigation, and modern equipment. Management of light may provide the means for even more dramatic increases.

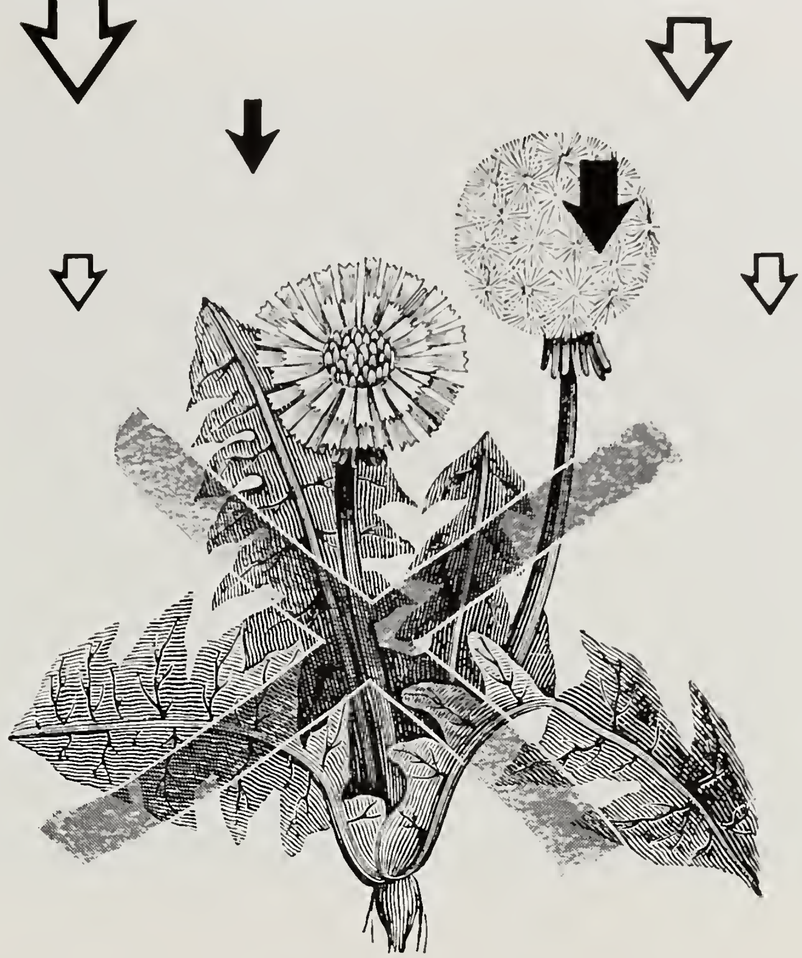
Pendleton and Peters nailed boards together and covered them with heavy-gage aluminum foil, creating reflectors 18 feet long by 6 feet wide. They placed the reflectors on the north side of a border row of corn planted in an east-west direction, about 2 feet from the row and angled so that light would be reflected into the lower and middle leaves of the corn canopy. They measured grain yields and plant characteristics in this light-rich area, in portions of the border row without reflectors, and in interior rows. All plants were watered and fertilized to achieve optimum growing conditions.

Yields from the light-rich areas were double those of interior rows and half again as large as the border rows that received normal sunlight. Plants in the light-rich areas were shorter and had thicker stalks. Multiple-ear plants occurred more frequently in the light-rich areas.

The researchers tried three seeding densities in their experiment. Normally lit plants fell farthest behind the reflector-lit plants when seed density was highest, because normal sunlight could not penetrate the canopies of closely spaced plants.

On sunny days, the reflectors heated up the air in front of them by 3° to 5° C. Some tip burning and leaf rolling was observed in the light-rich areas. In extremely hot, dry climates, reflectors would probably shrivel the corn.

In earlier studies, Pendleton and Peters experimented with strips of white plastic spread between rows of corn to bounce sunlight up into the lower leaves of the crop (AGR. RES., February 1966, p. 7). The technique improved yields by about 20 percent. Whether or not these light-reflecting techniques prove feasible on a large scale, it appears likely the next big breakthrough in corn production must come through better management of light. One possibility, the scientists say, would be breeding corn for smaller or more upright leaves to permit deeper penetration of light into the corn canopy.■



Turn on the light; turn off the weeds

LET THERE BE LIGHT and no more weeds. Scientists at Beltsville, Md., are studying how light controls the germination of weed seeds. They hope these studies will lead to a biological control of weeds.

Light is a fundamental requirement for the germination of many weed seeds. It may serve, therefore, as a key to the development of new methods for controlling weed seed germination. This could one day give scientists the ability to suppress entire weed populations.

The germination of seeds in response to light is controlled by phytochrome, a light-sensitive pigment in plants (AGR. RES., July 1965, p. 6, January 1968, p. 10). The pigment is changed by red light to a form that allows germination; far-red light changes the pigment to a form that inhibits germination.

While herbicides control many weed plants effectively, most have little effect on dormant weed seeds. Many of these seeds—a cup of soil may contain hundreds—remain dormant in the soil for years until conditions are favorable for germination, thus eluding the herbicides.

As farmers know, cultivation encourages weeds to germinate; this is because cultivation exposes seeds to light. Weeds generally fail to germinate, however, once a crop canopy covers the soil. At one time it was assumed that lowering of light intensity by the crop foliage reduced weed germination. Now scientists know that because leaves absorb certain wavelengths of light more than others, light passing through foliage is changed in quality as well as in intensity.

To explore what happens under the shade of a crop canopy, ARS plant physiologists R. B. Taylorson and H. A. Borthwick (who retired last month) exposed seeds of pigweed, lambsquarters, cinquefoil, yellow rocket, pepperweed and broadleaf dock to sunlight, to fluorescent, and to incandescent lights that had been filtered through tobacco leaves.

The scientists found that most of the seeds would not germinate under the leaf-filtered light because light from the red region of the spectrum, which promotes germination, was absorbed by the green chlorophyll in the tobacco leaves. Also, the light from the far-red region, which inhibits germination, was transmitted more freely through the leaves.

Leaves other than tobacco would act in the same manner to filter out germination-promoting red light and increase the relative amount of inhibiting far-red light.

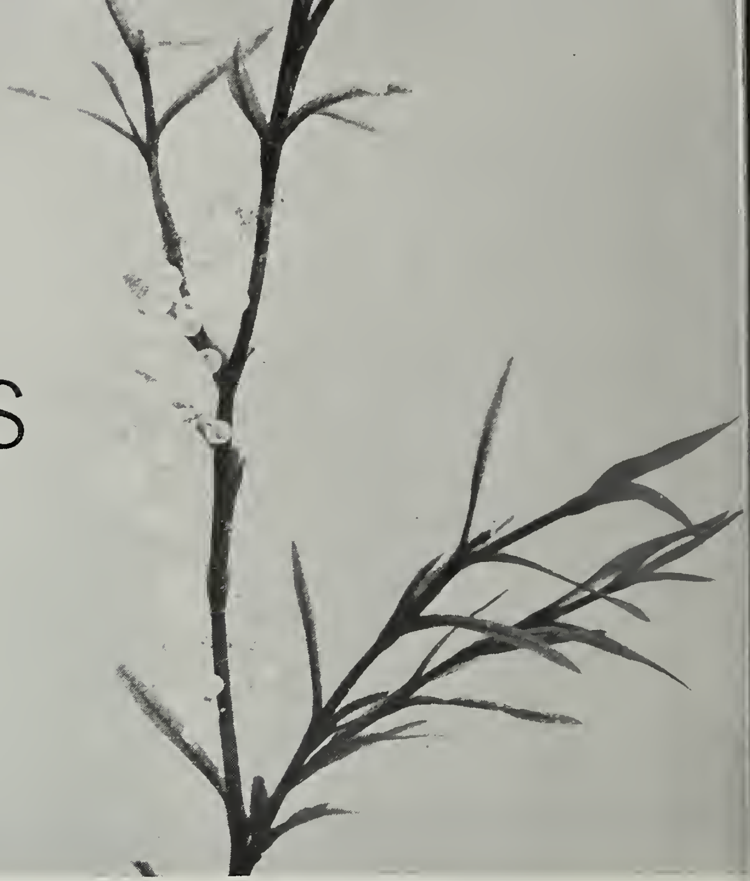
In effect, the chlorophyll in a dense leafy canopy acts to suppress germination of soil-borne weed seeds and gives scientists the possibility of developing new techniques for controlling weeds.

One possibility, says Taylorson, is mulching with a filter that absorbs red light, but transmits far-red light.

Another possibility is that scientists could learn how to trigger germination of the vast numbers of seeds lying dormant in the fields because of the absence of light; the weeds could then be killed by mechanical or chemical means.■

WEED EATING SNAILS

Biological Control of AQUATIC WEEDS



Egg mass of Marisa *snail (PN–1598).*

TWO WATER SNAILS from the rivers and streams of South America show promise in helping to control aquatic weeds in the United States.

ARS research agronomist R. D. Blackburn at Fort Lauderdale, Fla., found that the large tropical fresh water snails *Marisa cornuarietis* and *Pomacea australis* feed voraciously on such submerged aquatic weeds as elodea, southern naiad, coontail, and pondweed as well as on certain types of algae.

In 1965, Blackburn stocked three ponds in southern Florida at the rate of 8,000 *Marisa* snails per acre. One year later, the ponds, which ranged from about one-half to three-quarters of an acre, were free of submerged weeds and remained clean during 1966. Birds, rats, and certain fishes fed on the snails, but these predators did not prevent the snails from controlling weeds. The snail population fluctuated with the weed population. When all the weeds were gone, a few snails survived by feeding on algae.

Marisa, a very hardy snail that can tolerate highly polluted water, is a native of the Magdalena and Orinoco River watersheds, Colombia and Venezuela, respectively. It is often found far from home, turning up in Florida in 1957. The aquarium trade eagerly took up marketing the snail, but soon discovered its plant-eating habits and now regards it as an undesirable aquarium pest. *Marisa* is a dark brown snail that sometimes has thin, chocolate colored stripes. Its maximum size is $2\frac{1}{2}$ by $\frac{3}{4}$ inches.

In addition to its appetite for aquatic weeds, *Marisa* also controls other snails that carry diseases of man. Its voracious and indiscriminate eating habits allow it to eat the eggs of disease-carrying snails. *Marisa*, however, carries no diseases of man and has been used for food in Puerto Rico.

A primary aim of the *Marisa* research program, says Blackburn, is to develop the information needed for mass production of the snail to permit extensive evaluation and ultimately the practical use of the snail for aquatic weed control. In one study he found that *Marisa* population increased five to seven times in 10 weeks.

As a biological control agent for aquatic weeds, *Marisa* has two disadvantages. It eats rice, watercress, and waterchestnut; this trait would restrict its use in some areas of the world. And it cannot survive at temperatures below 48° F.

Pomacea, a large fresh water snail native to Brazil, is expected to tolerate lower temperatures than *Marisa*.

One can easily distinguish between the snails because *Pomacea* always lays its eggs above water, while *Marisa* attaches its egg masses to underwater vegetation, concrete, rocks or wood.

Research on *Pomacea* is recent, but preliminary experiments show that it feeds even more vigorously on many aquatic weeds than does *Marisa*. At this time, it looks as though it might become an effective biological control agent for aquatic weeds. ■

Experimental tank shows growth of Florida elodea when 6 Marisa *snails were introduced (PN–1599).*

Same tank (7 x 3 x 2½ feet) 24 weeks after introduction of Marisa *(PN–1600).*

Egg mass of Pomacea *snail (Its egg masses are always above water) (PN–1601).*

Adult Pomacea *snail (PN–1602). Cover photo is of adult* Marisa *(PN–1603).*

PASA's . . .

ONE OF THE POWERFUL weapons used by the United States in its global war on hunger is called a PASA—for Participating Agency Service Agreement.

PASA's are authorized under the provisions of the Foreign Assistance Act of 1961. The act empowers the Agency for International Development (AID) of the U.S. State Department to use its funds to draw on the technical competence of other Federal Departments in carrying out international assistance programs.

The first PASA between AID and USDA was executed on May 1, 1963; it called for USDA technical help in the agricultural development of El Salvador. Since then (through fiscal year 1967) USDA has provided approximately 1,000 personnel for PASA's in developing countries around the world, and ARS scientists have played prominent roles in project assistance.

Also (through fiscal year 1967), 12 ARS scientists have worked in El Salvador and, collectively, have made 22 trips there.

The main source of human protein in this small but important Central American country is a shiny black bean, which has become the target of numerous major diseases and at least seven insect pests. ARS scientists have assisted Salvadoran geneticists and entomologists develop a bean breeding program designed to incorporate disease and insect resistance, high

Powerful Weapons in the War on Hunger

protein content, high yields, and color and flavor acceptance.

Through the PASA, intensified research on edible oilseed crops such as soybeans, peanuts, and sesame have also been conducted in El Salvador, where a decline in the cottonseed industry has been a heavy blow. USDA has also supplied germ plasm to bolster that country's citrus economy, and ARS scientists are helping the Salvadorans eradicate fruit fly pests as well as the destructive avocado stenoma moth.

El Salvador's livestock industry has been plagued with disease and hampered by inadequate breeding programs. These problems have been reflected in an unusually low production of milk and meat. Despite a cattle population of 700,000 in ratio to nearly 3 million humans, per capita meat consumption is only around 13 pounds per year. Under the PASA, El Salvador veterinarians are learning the newest diagnostic methods for identifying tuberculosis, brucellosis, and rabies. And the use of coconut milk, introduced by PASA scientists, has made possible revolutionary improvements in the artificial insemination program.

The Brazilian PASA involves USDA's largest technical assistance group in Latin America. Twenty-two USDA specialists there are helping the Brazilian Government develop national projects which will encourage greater food production and improved market quality. The ARS wing of the USDA team is assigned to problem areas in marketing services and facilities—including the establishment of efficient wholesale units, proper grain storage facilities and procedures, grading standards, and retailing.

One of the outstanding PASA successes has been registered in a Kenya corn improvement project. Today, over one-half of Kenya's 300,000 acres of hybrid corn are grown by small farmers (AGR. RES. November 1967, p. 10), and there, too, under another PASA, ARS scientists are working with Kenyan scientists to develop methods for eradicating contagious bovine pleuropneumonia (CBPP). This disease first appeared in the United States in 1843. It was successfully stamped out here by the slaughtering of infected and exposed animals—a procedure which would be impractical in many areas of the world.

Every year thousands of cattle are lost in the protein-hungry nations of Africa and Asia because of CBPP. It is particularly insidious because an extended "carrier state" persists in many animals that have seemingly recovered. With research scientists in the United States backing them up, ARS scientists in Kenya and their Kenyan associates are working to develop a simple, yet accurate diagnostic field test for identifying recovered carrier animals, as well as a vaccine which will give practical immunity to CBPP.

For economic and religious reasons, millions of people in South Asia do not consume meat. High-quality, protein-rich pulse crops (e.g., peas, beans, lentils), therefore, become important sources of nutrient for these people.

More than 68 million acres of pulses are grown in the Near East-South Asia (NESA) and Far East countries. Exclusive of soybeans and peanuts, this is approximately three-fifths of the world's pulse acreage. However, yields in these regions are generally low because of inferior varieties, lack of fertilizer, poor cultural practices, and inadequate control of insects and diseases. In response to this problem, an AID–ARS PASA has six scientists in India and four in Iran, and they are already making progress in increasing yields over local varieties and in finding indigenous varieties with resistance to insect pests. In addition to improvement of crops by breeding and insect and disease controls, scientists in India and Iran are finding means of increasing production through soil management and plant nutrition studies. Protein quantity and quality are also important phases of this PASA.

Similar AID–ARS work is going on at other points of the globe—plant pest control in Ethiopia, agricultural development (selected fields) in South Vietnam, major cereal crops research in Uganda and Nigeria, and in U.S. laboratories—research on vegetable protein technology.■

Scientist with corn next to black-painted microwatersheds contrasting with that next to white-painted ones (PN–1604).

BLACK PAINTED MICROWATERSHEDS

A Way to Boost Corn Yields

PAINTING MICROWATERSHEDS black may provide just the push needed to make them the heart of a cropping system for more efficiently using the limited moisture in the dry Western States.

Microwatersheds are small man-made versions of the natural watersheds that conduct runoff water over a large area to a single point (AGR. RES. August 1964, p. 10). They are ridges of compacted earth, which may or may not be covered with concrete on both sloping sides. Trial crops are planted in the uncovered earth rows between them in tests to evaluate the effect of the microwatersheds on water use efficiency and plant growth.

In his early experiments, ARS soil scientist W. D. Kemper learned that covering the ridges with concrete solved weed control problems and partly remedied some of the problems associated with water absorption and excessive evapotranspiration from crop plants in the isolated rows.

In the current test, ARS soil scientist J. K. Aase, working with Kemper, found that planting corn next to black-painted slopes produced 40 percent higher yields than corn planted next to white-painted ones.

Corn planted next to black microwatersheds produced highest yields in terms of bushels of corn per inch of water used. The black surfaces also raised soil temperatures much higher in early spring, causing the corn to germinate quickly, grow rapidly, and mature before the onset of killing frosts.

In the middle of the growing season, corn next to black microwatersheds had more leaf surface and manufactured more carbohydrates. The researchers found that plants contained more chlorophyll, the substance necessary for photosynthesis and important in the production of dry matter.

Widths of watersheds and strips of soil varied in the tests, but best results were obtained with two rows of corn planted 1½ feet apart next to watersheds 6½ feet wide. All microwatersheds sloped 10 percent from the center to the earth strips.

The research is being conducted cooperatively with the Colorado Agricultural Experiment Station at Fort Collins, but 16 other Western States also have limited moisture. Insufficient moisture limits yields on 950 million acres of crop land and rangeland in the 17 Western States.

Covering large areas with concrete is not economically practical for corn, but may prove efficient for vegetable crops.

More information is needed on the effects of row spacing on transpiration and yields, and on ways to adapt the system to areas with short growing seasons.

The system is one of several that researchers are experimenting with for getting maximum use of available water in arid States.■

Pest infests alfalfa, cotton, sugar beets

Lygus Bug Has a Sweet Tooth

WHILE CHILDREN satisfy a sweet tooth with candy, young lygus bugs eat honeydew, the sugary waste secretion of mealybugs and aphids.

At Tucson, Ariz., ARS entomologist G. D. Butler accidentally discovered that immature lygus bugs or nymphs developing on the stem and leaves of alfalfa require honeydew. This discovery suggested to him that dipping plants in sugar solutions would make lygus rearing inexpensive and efficient.

The difficulty of mass rearing lygus bugs in greenhouses the year around has slowed research on the development of resistant plant varieties and insecticide screening.

It takes only a few lygus bugs to ruin a plant's seed crop. In feeding, the pests pierce the buds so that flowers drop and seeds cannot develop.

Butler knew that lygus bugs can develop on all parts—vegetative and fruiting—of unsprayed alfalfa, but was having the usual trouble rearing them on the vegetative parts of all but one of his greenhouse plants. He noted that a lone mealybug had survived insecticide spraying of that alfalfa plant.

Plants in the vegetative stage which Butler subsequently infested with mealybugs and aphids had a lygus bug nymph survival rate of over 90 percent compared to less than 14 percent on clean plants.

Butler suspected that the sugar source was responsible for the high survival rates. The mealybugs' honeydew supplied sugar to lygus bug nymphs on the vegetative plant; the nectar of buds and flowers provided sugar to those developing on the fruiting parts.

Dipping vegetative plants in a sugar solution, such as melezitose, sucrose, or honey, yielded similar lygus bug survival percentages without the wilting and stunting of plants that accompanies mealybug or aphid infestations.■

New Applicator for Nematocides

RESEARCHERS ALERT to often-overlooked damage inflicted by nematodes on plant roots have developed a comparatively safe and efficient device for injecting nematocides into nursery containers.

Nematodes are microscopic, parasitic round worms that cause root discoloration, enlargement, and decay. A. L. Taylor and J. H. O'Bannon, ARS nematologists in Orlando, Fla., developed the applicator to make nematocides practical for control of nematodes infesting nursery plants.

The diluted nematocide is pumped through a hose and probe. The operator pushes the pointed probe into each plant container, drenching the roots and crown of the plant from under the soil surface. Older, similar devices operated on faucet water pressure rather than motor power and lacked the new applicator's features for adjusting pressure, controlling flow, and agitating the nematocide mixture.

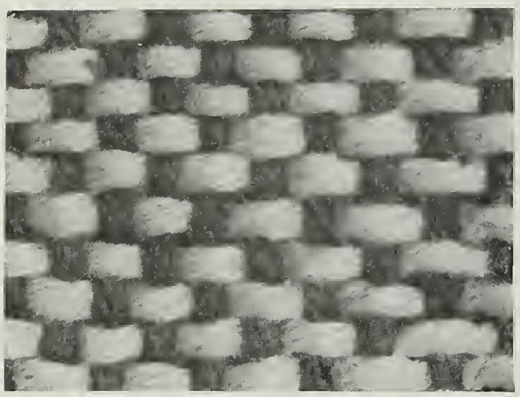
Use of the new subsurface drenching device has advantages over other methods nurserymen use to apply nematocides, such as drenching the soil surface, soaking soil balls removed from the container, or submerging the container into the chemical solution.

(*PN–1605*)

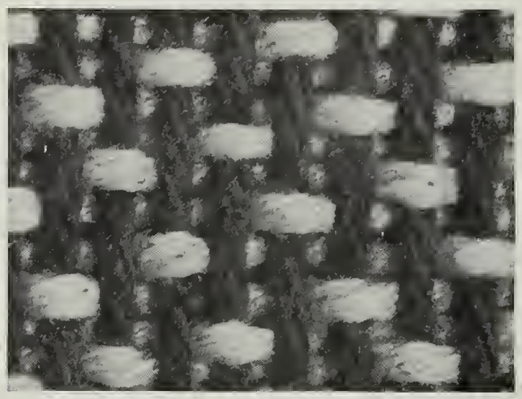
The operator has better control over the amount, direction, and rate of flow of the nematocide. This control method reduces labor costs, danger of overdosing the plants, and spillage of the chemical, and allows for more uniform and thorough application to the roots. Even large containers can be treated in less than a minute.

It is necessary to determine the proper dosage for each plant with each chemical, and operators must wear protective clothing.

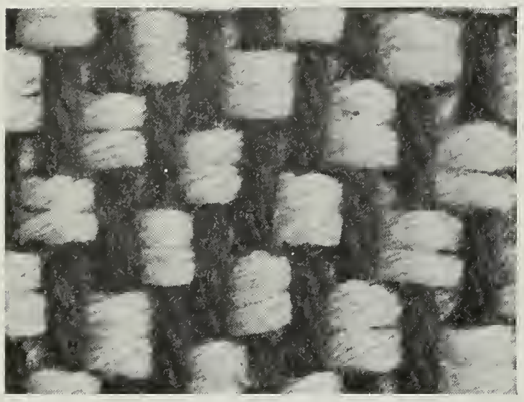
The applicator works with many types of chemicals and nursery plants, against many types of nematodes. It may also prove useful for applying fertilizers and various pesticides to plants both in and out of containers.■



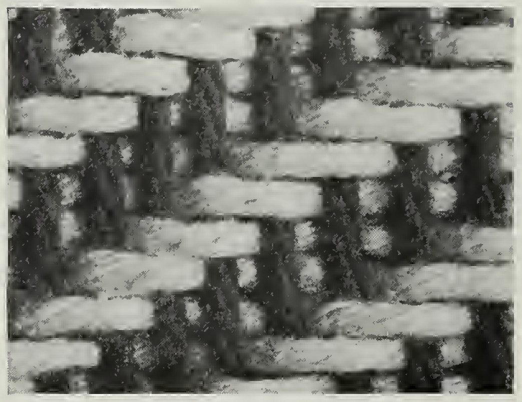
Plain



Sateen



Steep Twill



3/2 Regular Twill

Model of the types of weaves used in tests (PN–1606).

Cotton Fabric Structure Influences Wear Performances

FABRIC STRUCTURE strongly influences the wear performance of all-cotton durable-press garments. Wear performance is improved if yarns have freedom to move about in the fabric's structure, and if a good balance of yarns is exposed to the wear-causing forces.

These findings came from an ARS study in which 432 different fabrics were woven and evaluated. Undertaken as one phase of the total effort to determine how the abrasion resistance of chemically treated fabrics can be improved, the study showed that:

- Weave type influences fabric wear to a considerable degree.
- Fabrics made from heavy yarns outwear those of comparable weight made from lighter yarns.
- Fabrics made from single-strand or "singles" yarns outperform those made from two-strand or "ply" yarns of equivalent size.

Physicist G. J. Kyame and textile technologists J. T. Lofton and G. F. Ruppenicker, Jr., of the Southern utilization research laboratory, New Orleans, used four fabric weaves and 12 yarn types and sizes to make the 432 different fabrics

The fabrics were given a typical post-cure chemical treatment to achieve durable press finish and then made into trouser cuffs.

The cotton used was $1\frac{3}{8}''$ Pima S–2 variety and the weaves were a plain, a sateen, a steep twill, and a 3/2 regular twill. Size 60 and 40 yarns with different amounts of twist went to make up the plied yarns, while size 30 and 20 yarns, also with different amounts of twist, were used as the singles yarns.

All 432 fabrics received the same durable-press chemical treatment, and four trouser cuffs were made from each fabric for performance tests in home-type washers and dryers. Contrary to popular belief, such laundering causes much abrasion damage to durable-press garments.

In the tests, cuffs were put through up to 115 complete wash and dry cycles. All cuffs were examined for wear after each five cycles; rupture of a single yarn was classed as fabric damage. Wear was generally noted first in the points of the cuffs. After testing, the cuffs were rated for wash-wear appearance and sharpness of creases.

Within each group of fabrics made from yarns of the same size, wear occurred first in the plain woven fabrics (see photo). Next in order were sateens, steep twills, and 3/2 regular twills. Fabrics made from singles yarns outperformed comparable ones from plied yarns, while fabrics of coarser yarns outperformed those of finer yarns.

The good wearing qualities of 3/2 regular twills are believed due to a combination of freedom of yarn movement within the structure of the fabric, and a near balance in exposure of warp (lengthwise) and filling (crosswise) yarns to wearing forces. By contrast, a plain weave severely restricts yarn mobility, cancelling out the balanced exposure of warp and filling yarns to abrasion.

The relatively low resistance to abrasion in sateens is probably due to the extreme exposure of the warp yarns which outweighs the benefits of high yarn mobility. Although steep twills might be expected to resist abrasion as well as regular twills, examination of the filling yarns in the weave pattern shows a yarn interlacing similar to that of the plain weave which restricts yarn mobility.■

Cotton Is Treated With New Chemicals

Repels Oil, Stays Washable

Any fabric that will repel salad dressing surely will repel water unless it's cotton that's been treated with experimental finishes developed by ARS scientists.

Resistance to oil but not to water is a highly improbable combination because, as the ARS investigators explain, "when you build in oil resistance you normally build in water resistance. Water resistance is undesirable in most fabrics—it makes them difficult to launder because they don't get wet."

But it's different when cotton is treated with either of two chemical treatments being tested at the Southern utilization research laboratory, New Orleans. This treated fabric has high resistance to oil, but low resistance to water and detergent.

One of the main objectives of this research is to give wash-and-wear and other chemically modified cotton fabrics resistance to the oily soiling that often occurs in close-fitting parts of clothing, such as men's collars. Preliminary tests indicate treated fabrics have this kind of resistance, plus resistance to staining by meat fats and vegetable oils. Tests for resistance to other types of stains have not yet been conducted.

Like most present stain resistant finishes, the two now under development depend on fluorine-containing compounds that ordinarily make fabrics repel both oil and water. The ARS chemists found that by adding other chemicals in carefully determined amounts, they can reduce water repellency without adversely affecting oil repellency.

The unusual effects of the mixtures in both finishes provide resistance to oily stains, but allow penetration by laundry detergents to help remove soil and any stains that do get into the fabric.

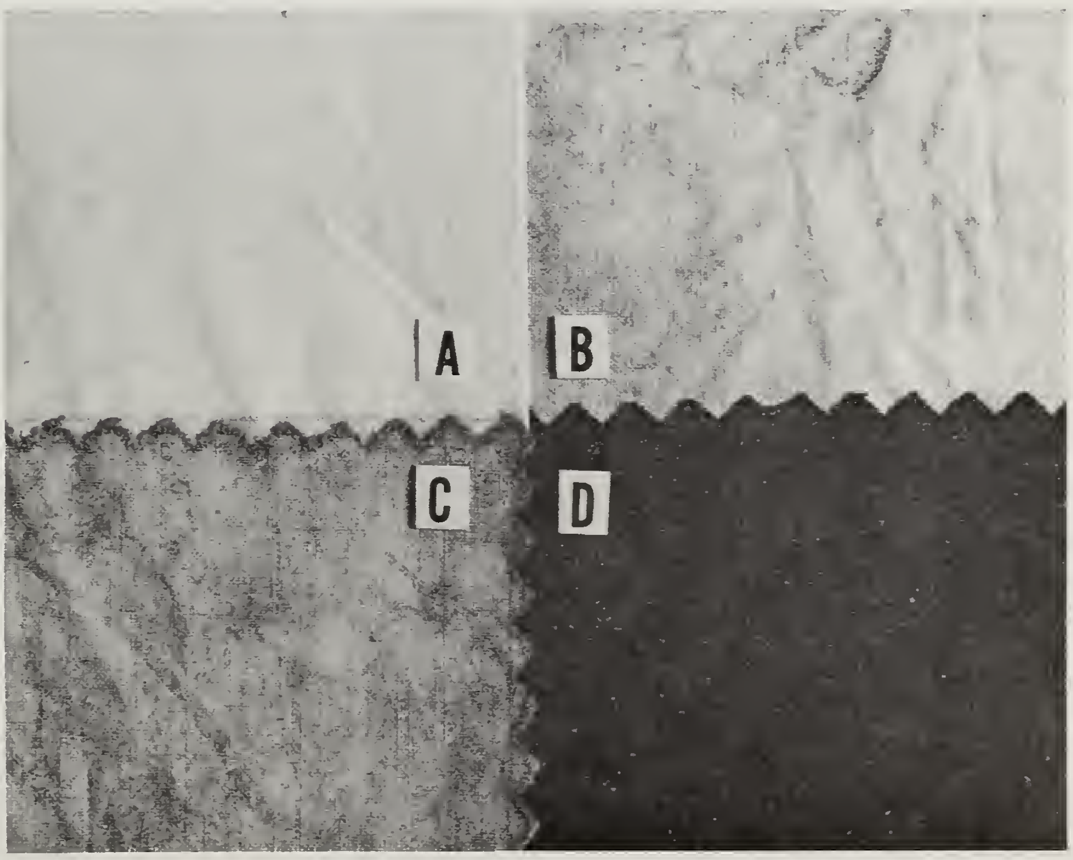
One of the finishes is based on a mixture of ethyl perfluorooctanate (EPO) and polyethylenimine (PEI). Cotton fabric is wetted in the solution and the finish is fixed by drying fabric at moderate temperatures.

The other finish is based on a mixture of dihydroperfluorooctylamine (POA) and tetrakis(hydroxymethyl) phosphonium chloride (THPC). Cotton fabric is wetted in the solution, dried, and exposed to ammonia fumes. The ammonia fumes fix the finish.

Chemists G. L. Drake, Jr., J. P. Moreau, S. E. Ellzey, Jr., W. J. Connick, Jr., and W. A. Reeves conducted the research at the Southern utilization research laboratory.

The finishes, in their present state of development, are good only for colored fabrics. The chemicals cause white fabrics to yellow. Neither finish was seriously affected by 15 home-type laundering cycles. The chemists say this is an indication that the finishes are durable, but more severe testing needs to be done.

As the chemists try to perfect the new finishes, they will try to combine the chemicals with those used to make permanent press cottons, which tend to stain easier than untreated cotton.■



Cotton fabrics. A—Untreated, unsoiled. B—Untreated, soiled and laundered. C—Experimental stain-repellent fabric after soiling and laundering. D—A commercial stain-repellent fabric after soiling and laundering. Carbon black suspended in oil was forced into fabric with squeeze rolls (PN–1607).

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AGRISEARCH NOTES

Floating Granules Again

The floating granule technique used with formulations of 2,4–D has been found by ARS researchers to be very effective against Eurasian watermilfoil.

While there are two other species of this aquatic pest, Parrotfeather and Broadleaf, found in Florida, Eurasian poses the biggest threat to irrigation, navigation, fishing, and water sports. The weed can survive in water one-third as salty as the sea. Eurasian threatens the Chesapeake Bay in Maryland, and the Crystal-Homosassa River Basin in Florida as well as areas in other states.

The fast-spreading Eurasian watermilfoil, a beautiful and popular aquarium plant, was established by tropical aquatic plant dealers in 1954 as a source of supply.

Perlite, a light volcanic glass, serves as a carrier that is saturated with herbicides, in the floating granule technique (AGR. RES., October 1967, pp. 8, 9).

The herbicide 2,4–D has not yet been registered by the Department for use on water that is used for irrigation, stock, or drinking purposes.

Simple Soil Sampler

A soil sampler—newly developed by ARS—is delicate enough to split a vertical earthworm tunnel without disturbing the half that remains in the ground.

ARS researchers in cooperation with the Idaho Agricultural Experiment Station at Kimberly developed this hand-operated device to help scientists obtain undisturbed cores of soil for description, laboratory tests, and exhibits.

It brings up samples 3⅜ inches in diameter and up to 9 inches in length. A longer core can be obtained with an attachment. The device consists of a nonrotating sample holder inside a spiraled, rotating casing with cutting edge. There are only four basic parts.

Besides being superior to many other samplers where minimum disturbance of the composition of the soil and sample is desired, the new device operates in almost all kinds of soil, from heavy clay loam to fine-textured sand. Its size and design permit boring at any angle.

Its small size also makes it useful for sampling where terrain prohibits large, motor-driven devices. Only two men are needed to operate and carry the sampler; it can be transported easily in a car.

Soybeans Versus Weeds

Scientists at Stoneville, Miss., found that the soybean varieties—Semmes and Bragg—outyielded four other adapted varieties when weed competition was severe.

Lee, usually the most productive variety, did best on weed-free plots. In competition with weeds, however, Semmes and Bragg both outproduced Lee. These two varieties grow more rapidly than others and were therefore more competitive with weeds.

ARS plant physiologist C. G. McWhorter and agronomist E. E. Hartwig conducted the tests in cooperation with the Mississippi Agricultural Experiment Station at Stoneville.

Johnsongrass and cocklebur are serious weed problems that cost Southern soybean growers hundreds of thousands of dollars each year. The results of the studies show that soybean varieties vary in competitiveness with weeds, and this suggests that certain varieties may be preferable to others in areas infested with specific weeds.

While, of the six varieties tested, Bragg and Semmes both showed superior competitiveness, Semmes did a little better than Bragg in cocklebur competition.

The ARS scientists grew the different varieties in plots infested with Johnsongrass, with cocklebur, and in plots that were weed-free.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.